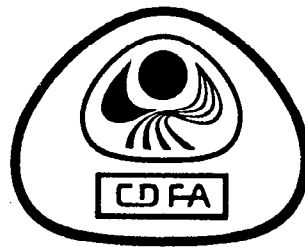


# MONITORING OF THE 1984 GYPSY MOTH ERADICATION GROUND SPRAY PROGRAM IN ALAMEDA AND SAN DIEGO COUNTIES



ENVIRONMENTAL HAZARDS ASSESSMENT PROGRAM

STATE OF CALIFORNIA  
DIVISION OF PEST MANAGEMENT, ENVIRONMENTAL PROTECTION  
AND WORKER SAFETY  
UNIT OF ENVIRONMENTAL MONITORING AND PEST MANAGEMENT  
1220 N STREET, SACRAMENTO, CALIFORNIA 95814

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MONITORING OF THE 1984 GYPSY MOTH ERADICATION GROUND  
SPRAY PROGRAM IN ALAMEDA AND SAN DIEGO COUNTIES

BY

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Environmental Hazards Assessment Program  
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## ABSTRACT

Monitoring of carbaryl (Sevin) applications was conducted in Alameda and San Diego counties during the 1984 gypsy moth eradication program. Air and foliage samples were collected from one residence in each county and water samples were collected from a stream or river running through each treatment area. Concentration of carbaryl in air during the spraying was 4.10 micrograms per cubic meter in Oakland and 0.55 micrograms per cubic meter in San Diego. These concentrations fell within the range previously established in Santa Barbara Co. in 1982. No carbaryl was detected in background water samples taken from streams before spraying began. No rain runoff samples were collected in either county due to insufficient rainfall during the study period.

Dislodgable carbaryl residues on leaves collected in Oakland during a 12 day post spray period were similar to results for previous years. However, the foliage sampling in San Diego Co. was conducted for a substantially longer period (21 days) and a dissipation of dislodgable carbaryl residue was demonstrated for the first time.

#### ACKNOWLEDGEMENTS

We are indebted to Michael Green, Alameda County Agricultural Commissioner, and his staff; and to Kathleen Thuner, San Diego County Agricultural Commissioner and her staff for their assistance in establishing monitoring sites. Thanks is extended to John Connell and Jim Rudig for their assistance.

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## I. INTRODUCTION

The Environmental Hazards Assessment Program (EHAP) of the California Department of Food and Agriculture (CDFA) was requested to monitor the Gypsy Moth Ground Spray Program conducted during the spring of 1984. The specific objective was to establish that residues of the insecticide carbaryl (Sevin) remained within the acceptable ranges previously documented in Santa Barbara, Ca., in 1982 (Neher, L.A., Segawa, R.T., Oshima R.J., 1982. Monitoring of the 1982 Gypsy Moth Eradication Ground Spray Program in Santa Barbara County. California Department of Food and Agriculture, Sacramento. 50 pp.). This study involves the monitoring of air, foliage and natural bodies of water for the presence and quantification of carbaryl within the treatment areas of Alameda and San Diego Counties. Results have been disseminated to agencies and physicians responsible for evaluation of health and environmental exposure impacts.

## II. SITE SELECTION

One residential site was selected in each county for the monitoring of carbaryl levels in air and on foliage. Each residence was selected based on ease of access, availability of electricity, and availability of suitable host foliage.



Other sampling sites were selected along streams flowing through or adjacent to the spray area to determine the carbaryl levels in natural bodies of water.

### III. PESTICIDE FORMULATION AND APPLICATION

The Sevin 80S (80% active ingredient: Carbaryl 1-naphthyl-N-methylcarbamate) was mixed to a working concentration of 1.25 pounds per 100 gallons of water; equivalent to 0.120% active ingredient or 1200 PPM. All mixing was done directly in the 100 to 500 gallon tanks mounted on hydraulic ground spray trucks and kept under constant agitation during application. Buffer was added to the spray tanks as necessary to maintain a pH of approximately 6.5.

### IV. GENERAL MATERIALS AND METHODS

#### a. AIR SAMPLING

High volume (HiVol) air samplers, calibrated at 30 cubic feet per minute, were used to collect air samples outside private residences within the spray zones. A background air sample was taken at each site for a 6 hour period before the spray. Another sample was collected during the spraying of the property plus 1/2 hour afterward. A final sample was

collected for a six hour period after the application. All HiVol samples were immediately stored on dry ice following collection and were kept frozen during shipment and prior to analysis.

#### b. WATER SAMPLING

Replicate water samples were collected in 1 liter amber glass bottles, filled to capacity, and sealed with Teflon lined caps. Background water samples were collected upstream and downstream from the treatment area prior to the first application of carbaryl. In the event of substantial rainfall, additional replicate water samples were to be taken to determine levels of carbaryl in the rain runoff.

#### c. FOLIAGE SAMPLING

Foliage samples were collected from a host tree at one treatment site in each of the counties being monitored. Duplicate samples consisting of 20-30 leaves were taken prior to the first application, one half hour after the first application, and every other day up to the time that the second application was made to the property.

#### d. TANK SAMPLES

The spray mixture was sampled directly from the spray nozzle at application time and collected in 500 ml amber glass bottles with Teflon lined caps. The sample was immediately packed in wet ice and then kept refrigerated until

analysis.

e. SAMPLE SECURITY

Each sample collected was accompanied by a chain of custody form (Appendix A) documenting the sequence of transfers from sample preparation through chemical analysis. Every individual who handled the sample was required to sign and date the form, acknowledging receipt and relinquishment of the sample.

V. ALAMEDA COUNTY MONITORING PROCEDURES

The treatment area encompassed 170 acres within the city of Oakland (Figure 1). A single residence was sampled on March 26, 1984 to determine levels of carbaryl in the air and for the collection of a spray tank sample. In addition, foliage samples were collected to determine the rate of carbaryl dissipation on foliage. Background water samples were collected on March 25 from the Millmont Branch of Lyons Creek where the stream first enters the spray area and again downstream from the treatment area. Rain runoff samples were to be collected following the first substantial rainfall.



## VI. ALAMEDA COUNTY RESULTS

### a. AIR

Levels of carbaryl in the background, spray, and postspray air samples (Table 1) fell within the range of values documented for the 1982 Santa Barbara Gypsy Moth spray program.

Table 1. Concentrations of carbaryl, expressed as time weighted averages, in air samples collected outside of a residence in Oakland.

Sampling Period	Date	Time	Carbaryl	
			ug/m <sup>3</sup>	ppb
Background	03/26	0400-1000	0.02	2.0 x 10 <sup>-3</sup>
Spray	03/26	1428-1525	4.10	0.50
Post Spray	03/26	1530-2130	0.43	0.05

### b. WATER

No carbaryl was detected in background samples taken from a creek (Table 2), and due to the lack of substantial precipitation during the study period, rain runoff samples could not be taken.

Table 2. Concentrations of carbaryl in water samples collected in Oakland.

Sampling Period	Date	Time	Carbaryl	
			Upstream	Downstream
Background	03/25	1600	N.D. <sup>a/</sup>	N.D.
Rain Runoff			Not Collected <sup>b/</sup>	

<sup>a/</sup> None Detected. Minimum detectable level= 1.0 ppb

<sup>b/</sup> There was not sufficient rainfall for collection of rain runoff.

c. FOLIAGE

No carbaryl was detected on background foliage samples collected prior to the commencement of the ground spray program. Figure 2 depicts the concentration of dislodgable carbaryl over the 12 day period.

d. SPRAY TANK

The duplicate tank samples had a pH of 6.2 and a mean carbaryl concentration of 0.108%, approximately 90% of the theoretical concentration, (1.25 lbs. Sevin 80S in 100 gallons of water).

VII. SAN DIEGO COUNTY MONITORING PROCEDURES

The treatment area was located in the city of San Diego (Figure 3). A single residence was sampled on March 22, 1984 to determine levels of carbaryl in the air and for the collection of a spray tank sample. In addition, leaf samples were collected to determine the rate of carbaryl dissipation on foliage. Water samples were collected from the San Diego River which flows through the treatment area. Replicate water samples were collected from sites upstream and downstream from the treatment area. Background samples of air, foliage, and water were collected on March 20,

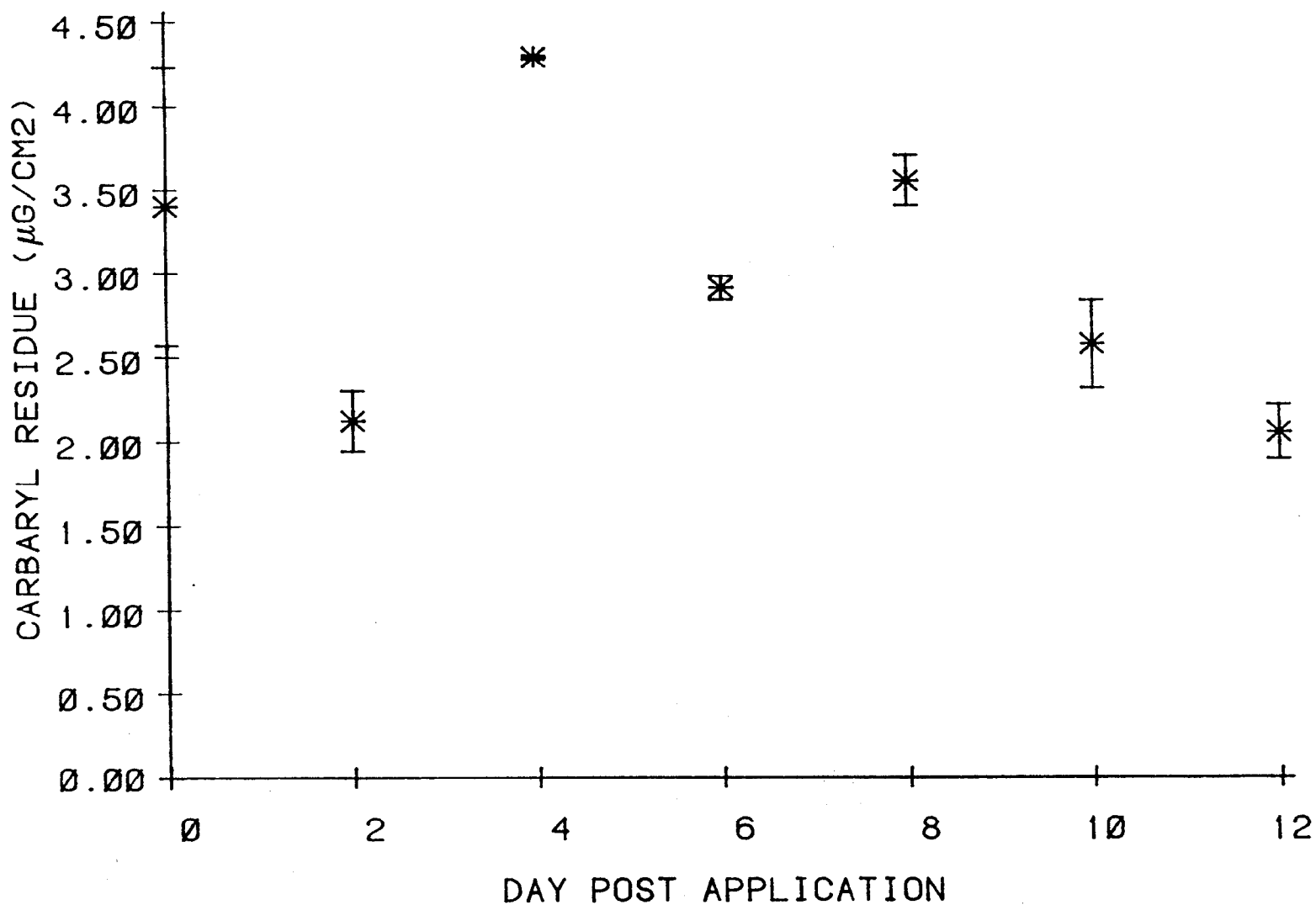


FIGURE 2. DISLODGBLE FOLIAR RESIDUES OF CARBARYL FOR SAMPLE SITE IN OAKLAND IN  $\mu\text{G}/\text{CM}^2$ . EACH POINT IS THE MEAN OF TWO SAMPLES. THE STANDARD ERROR FOR THE MEANS OF TWO SAMPLES IS GIVEN BY VERTICAL BARS.

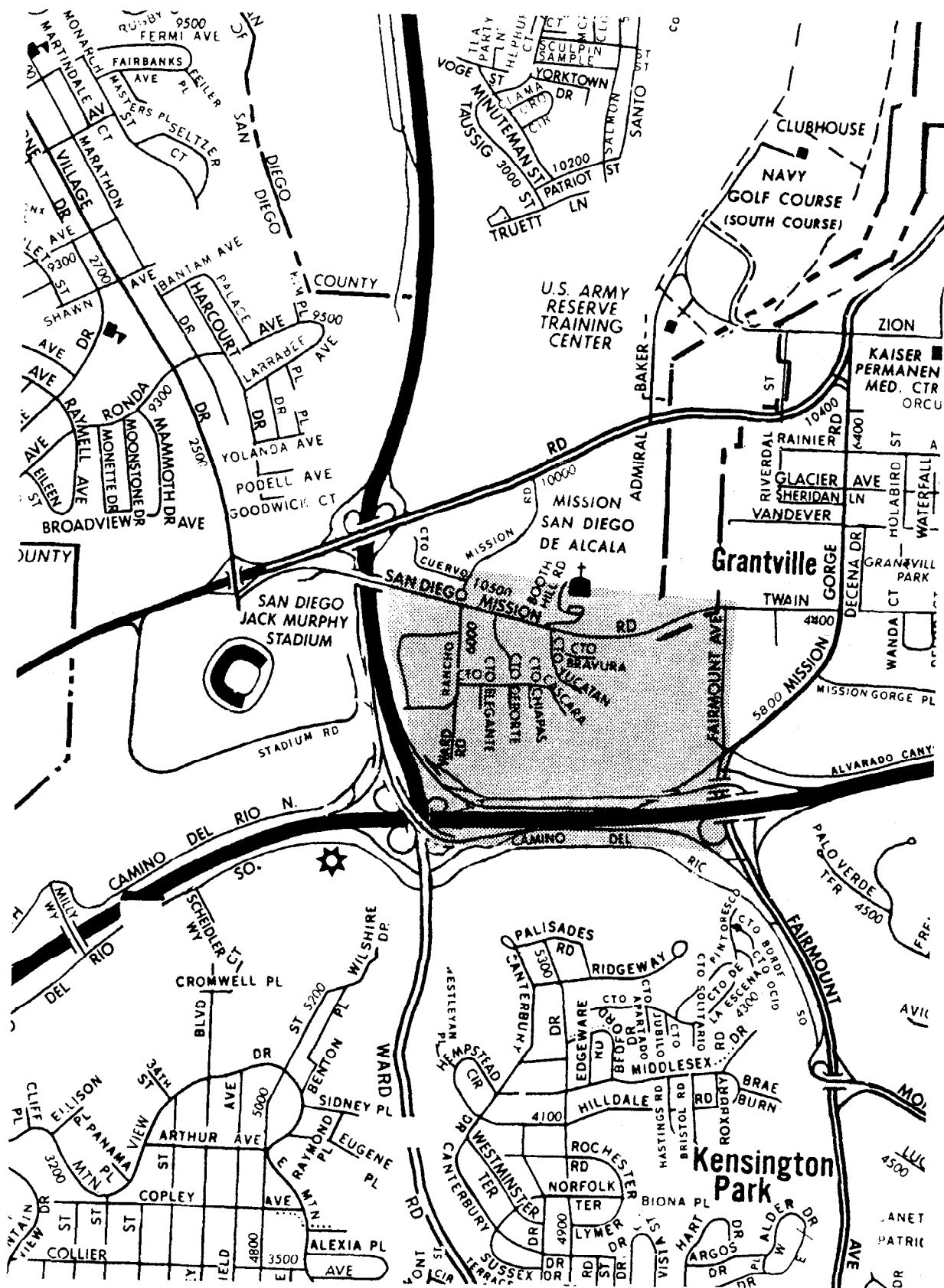


FIGURE 3. GEOGRAPHIC LOCATION OF THE GYPSY MOTH SPRAY AREA IN SAN DIEGO.



1984. Rain runoff samples were to be collected following the first substantial precipitation.

#### VIII. SAN DIEGO COUNTY RESULTS

##### a. AIR

Levels of carbaryl in the background, spray, and postspray samples (Table 3) fell within the range of values documented for the 1982 Santa Barbara Gypsy Moth spray program.

Table 3. Concentration of carbaryl ( $\mu\text{g}/\text{m}^3$ ) and ppb, expressed as a time weighted average, in air samples collected outside of a residence in San Diego.

Sampling Period	Date	Time	Carbaryl	
			$\mu\text{g}/\text{m}^3$	ppb
Background	03/20	1115-1720	N.D.	N.D.
Spray	03/22	0855-1400	0.55	0.07
Post-spray	03/22	1400-1900	0.05	$6.70 \times 10^3$

##### b. WATER

No carbaryl was detected in background samples taken from the San Diego River (Table 4) and due to the lack of substantial rainfall during the study period, runoff samples were not taken.

Table 4. Concentrations of carbaryl in water samples collected from the San Diego River.

Sampling Period	Date	Time	Carbaryl	
			Upstream	Downstream
Background	03/20	1200	N.D. <sup>a/</sup>	N.D.
Rain Runoff		Not collected <sup>b/</sup>		

<sup>a/</sup> None Detected. Minimum detectable level= 1.0 ppb.

<sup>b/</sup> There was not sufficient rainfall for collection of rain runoff.

#### c. FOLIAGE

No carbaryl was detected on foliage samples collected prior to the Gypsy Moth Ground Spray Program, and all values for post spray samples fell within the range previously documented in Santa Barbara (Fig. 4). A Student's t-test indicated a significant decline ( $p < .01$ ) in carbaryl concentrations between 0 and 20 days post application. The best fit regression line (Fig. 5) had the following equation:

$$\text{Carbaryl (ug/cm}^2\text{)} = 2.4 - (2.1 \times 10^{-4})x(\text{days post application})^3$$

This line had an R-squared value of 0.76, indicating that 76% of the variation is accounted for by the line.

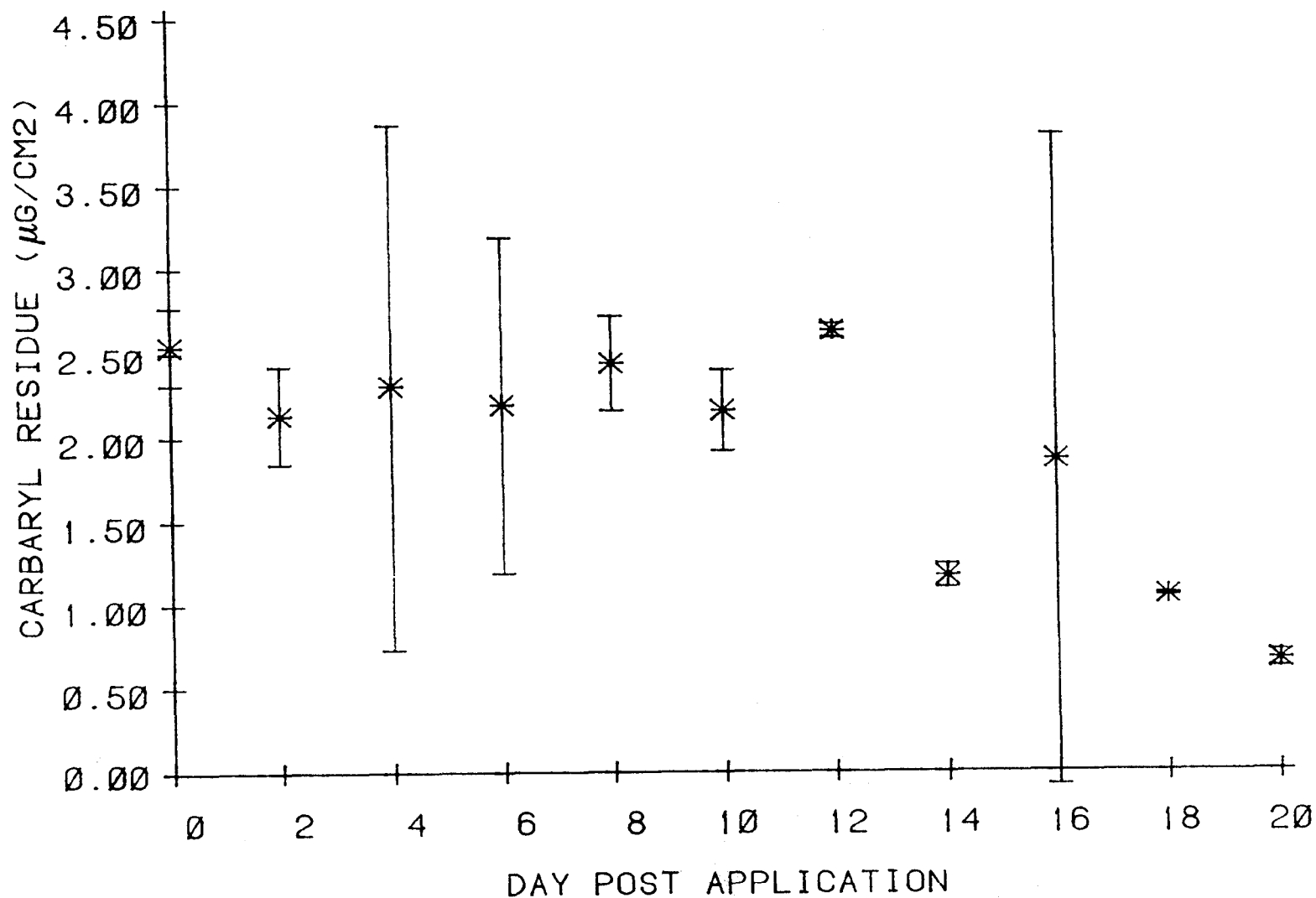


FIGURE 4. DISLODGABLE FOLIAR RESIDUES OF CARBARYL FOR THE SAMPLE SITE IN SAN DIEGO IN  $\mu\text{G}/\text{CM}^2$ . EACH POINT IS THE MEAN OF TWO SAMPLES. THE STANDARD ERROR FOR THE MEANS OF TWO SAMPLES IS GIVEN BY VERTICAL BARS.

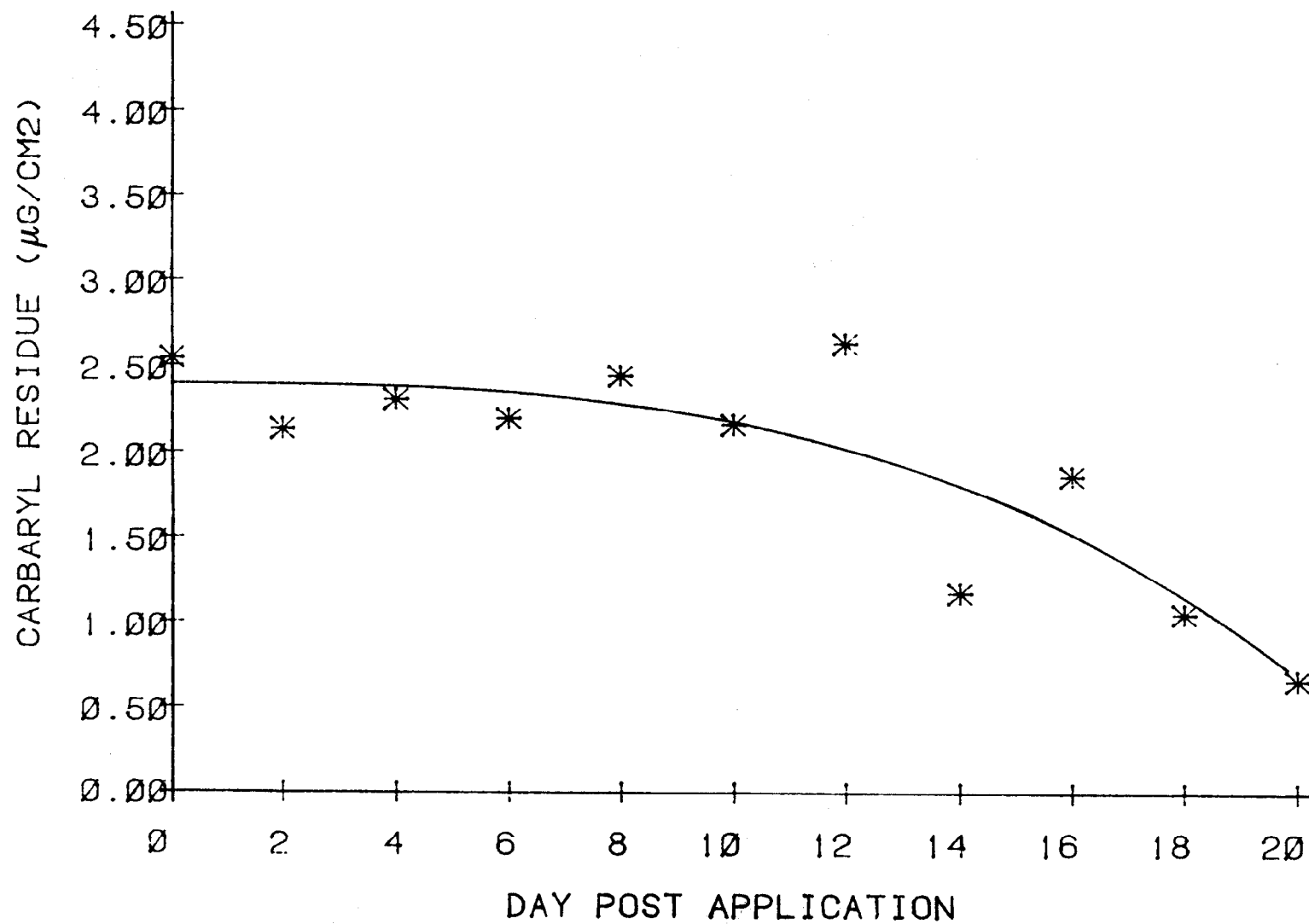


FIGURE 5. REGRESSION PLOT OF FOLIAR CARBARYL RESIDUES ( $\mu\text{G}/\text{CM}^2$ ) FOR SAMPLE SITE IN SAN DIEGO.

## IX. DISCUSSION

Air concentrations of carbaryl detected in both treatment areas in 1984 fit within ranges established in previous years. Data collected in 1981, 1982 and 1983 showed background concentrations from no detectable amount to 0.068 ug/m<sup>3</sup>, spray concentrations of 0.13-12.0 ug/m<sup>3</sup> and post-application concentrations between 0.04 and 0.95 ug/m<sup>3</sup>.

The dislodgeable leaf residue data for Oakland also agrees with that collected in prior years. No statistically significant dissipation of carbaryl was observed during the 12 day study period in Oakland. A dissipation of dislodgeable leaf residue was observed in San Diego County and this was the first documented degradation for a gypsy moth spray program in California. However, the San Diego program was different from previous programs in that it was the only one which had a 21 day interval between the first and second treatment, when the leaves were sampled. Additionally, it was also the only leaf sampling which EHAP personnel did not conduct.

With the exception of the San Diego leaf data, the results of this gypsy moth monitoring program substantially agree with previous results.

A P P E N D I X   A

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DEPARTMENT OF FOOD  
AND AGRICULTURE

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ENVIRON. HAZARDS ASSESSMENT  
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SACRAMENTO, CA 95814

Study #					Sample #					Date On					Date Off					Person Collecting		Key Location		Key		
										Mo	Day	Yr	Time On	Mo	Day	Yr	Time Off			Area	Site	Period	Spray	Sample type		
-	-	2	5																							

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40

Replicate #					Companion #					pH					Carbaryl					Units		Chemist		Lab #		Sample status	

41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

Partner:		Location:		Lab Results:		Save Leaves					
Remarks, other chemicals, etc.				Carbaryl							
				Chemist:				Date:			
				Relinquished by: (Signature)		Date/Time					
				Received by: (Signature)		Relinquished by: (Signature)		Date/Time			
Area:		Sample type:		Received by: (Signature)		Relinquished by: (Signature)		Date/Time			
OA = Oakland		HIV = Hi-vol									
SD = San Diego		LEA = Leaves									
		TAN = Tank									
		WAT = Water									
Period:		Sample status:		Received by: (Signature)		Relinquished by: (Signature)		Date/Time			
B = Background		B = Bad									
S = Spray		S = Special									
P = Post spray		P = Priority		Received for Laboratory by: (Signature)		Date/Time		Lab #			

Distribution: Original & One Copy Accompanies Shipment, Copy to Coordinator Field Files.

APPENDIX B



PROTOCOL FOR MONITORING OF THE 1984  
GYPSY MOTH ERADICATION GROUND  
SPRAY PROGRAM

I. Objective

To monitor the environmental levels of pesticides applied during the 1984 Gypsy Moth Eradication Program.

II. Personnel

The monitoring of the gypsy moth eradication ground spray program will be conducted by personnel in the Environmental Hazards Assessment Program (EHAP) under the overall supervision of Ronald J. Oshima. All inquiries regarding the progress and/or results of any facet of the monitoring program should be directed to Ronald Oshima in Sacramento (phone 916-322-2395 or ATSS 492-2395).

Joe Franz - Responsible for selection of sampling methodology, field storage and transport of collected samples, and liaison to CDFA Chemistry Laboratory Services. Questions concerning all aspects of the chemical analysis of collected samples should be directed to him (phone 916-322-2395 or ATSS 492-2395).

Monitoring in affected counties will be assigned to specific EHAP personnel. The following individuals will be responsible for liaison with state, county and local officials involved with the local eradication program.

Alameda County	-	Joe Franz
San Diego County	-	Scott Simpson

III. Study Timetable

Field monitoring will coincide with the implementation of the gypsy moth eradication efforts on an area basis. A single treatment, will be monitored in each selected area to insure that pesticides levels remain in the ranges previously documented in Santa Barbara, 1982.

IV. General Monitoring Plan

By monitoring treatment areas within Alameda and San Diego counties, EHAP will attempt to determine the presence of detectable pesticide concentrations in air and natural bodies of water. One private residence that is scheduled to be sprayed in Oakland and San Diego will be selected as a monitoring site.

a) Air will be sampled by high volume air samplers (HV). HV's utilizing an adsorbant resin bed and electronic flow controllers, will operate at a flow rate of 30 cubic feet per minute (CFM). Samples will be collected

from outside the residence during each of the following periods: 6 hr background, spray plus 1/2 hr., and for 6 hrs. post spray.  $2 \times 3 = 6$  samples

b) Duplicate water samples will be drawn from any stream or creek flowing through a treatment area. These will include a background sample taken downstream of the treatment area and post spray samples from downstream and upstream of the treatment areas.  $2 \times 2 \times 3 = 12$  samples

c) Duplicate rain runoff samples will be drawn from sites above and below the treatment area following the first significant rainfall. Those samples will be collected from streams, creeks and/or drainage systems that drain the treatment area.  $2 \times 2 \times 2 = 8$  samples

d) Tree foliage- In order to determine pesticide levels present on tree foliage over time, a host tree will be chosen at one treatment property. Duplicate samples consisting of a minimum of 20-30 leaves will be taken during each of the following periods: background, spray, and every other day up to the spray. Additional samples will be taken on later dates if necessary.  $2 \times 2 \times 10 = 40$  samples

e) Tank samples will be collected during or immediately following all monitored applications.

#### V. Handling and Storage of Samples

All sampling media and containers will be prepared and pre-numbered at the California Department of Food and Agriculture Laboratories in Sacramento. Each device or container will be shipped to the sampling sites with an accompanying Chain of Custody Record. The Chain of Custody Record will be filled out by all parties handling or storing the sampling media or sample containers from the time they leave the Sacramento DFA lab until they are returned to the lab for analysis. The Chain of Custody Record also contains an internal chain of custody record for use by the laboratory.

All samples will be collected by EHAP personnel, sealed in glass containers and stored in the following manner until and during transport to the CDFA laboratory in Sacramento.

On Dry Ice ( $-70^{\circ}\text{C}$ )  
air samples  
~~foliar samples~~

On Ice ( $1^{\circ}\text{C}$ )  
tank samples  
water samples  
**FOLIAR SAMPLES**

#### VI. Analysis of Samples

All samples will be analyzed by CDFA Chemistry Laboratory Services in Sacramento. Quality control duplicate samples will also be analyzed by CDFA. Approximately ten percent of the total number of samples of each type

collected will have duplicate analyses performed as part of the quality control program. Brief details of the analytical methods for each type of sample are available if requested.